

# A Comparative Study to Find Out the Aesthetic Relationship between Facial and Dental Parameters in Saudi Population

Aead M. Algarni<sup>1\*</sup>, Khulud F. Alazmi<sup>2</sup>, Ayman M. AlGhamdi<sup>3</sup>, Rayan M. Eskandrani<sup>4</sup>

<sup>1</sup>Department of Restorative Dentistry, Ministry of Health, Asir, Saudi Arabia

<sup>2</sup>Department of Orthodontist, Riyadh Elm University, Riyadh, Saudi Arabia

<sup>3</sup>Department of Restorative Dentistry, Ministry of Health, AlBaha, Saudi Arabia

<sup>4</sup>Department of Restorative Dentistry, Ministry of Health, Riyadh, Saudi Arabia

\*Corresponding author: dr-aead@hotmail.com

Received August 10, 2019; Revised September 26, 2019; Accepted October 17, 2019

**Abstract** Aim: To evaluate the relationship between dental complex and facial parameters (bizygomatic width, interalar width, and inter-papillary plane) among the Saudi population. Methods and materials: Patients visiting dental clinics at Riyadh Elm University were incorporated for the present study. Total of 200 volunteers (100 males and 100 females) were included, with a mean age of  $26.51 \pm 6.33$  and  $26.58 \pm 5.54$ , for males and females, respectively. Measurements for the bizygomatic width (BZ) relation with the width of the upper central incisor (CI), interalar width (IA) relation with the width of maxillary intercanine (IC), and interpupillary plane parallelism with the upper dental plane were carried for every volunteer with the help of digital caliper, fox plane and casts. All the comparisons were made in the light of aesthetic rules. A written and signed consent form was obtained from each volunteer before their inclusion in the experiment. To measure the relationship between dental complex parameters with facial parameters among all the volunteers, Pearson's correlation test was performed. Results: A weak to moderate positive correlation was found in BZ (facial parameter) and IC (dental complex parameter), as well as for IC (dental complex parameter) and IA (facial parameter). In contrast, a weak negative correlation was observed for CI (dental complex parameter) and IA (facial parameter), and also CI (dental complex parameter) and BZ (facial parameter). The measurements for inter-pupillary and occlusal planes of all subjects exhibited parallel to each other. Conclusion: A positive and strong aesthetic relationship between facial features and dental complex is present among the Saudi population. Furthermore, aesthetic measurements among the Saudi population also tends to be parallel to current standard of aesthetic practices.

**Keywords:** *aesthetic, bizygomatic width, dental complex, facial complex, interalar width, intercanine width, interpupillary, occlusal planes*

**Cite This Article:** Aead M. Algarni, Khulud F. Alazmi, Ayman M. AlGhamdi, and Rayan M. Eskandrani, "A Comparative Study to Find Out the Aesthetic Relationship between Facial and Dental Parameters in Saudi Population." *International Journal of Dental Sciences and Research*, vol. 7, no. 2 (2019): 38-43. doi: 10.12691/ijdsr-7-2-3.

## 1. Introduction

The relation between the size of the face and the size of teeth was found by Leon William's [1]. Thus paving the way for edentulous patients and patients concerned with their teeth and facial aesthetics. All the patients should be content with their facial structures. A study by Lombardi, stated that a pleasing proportion of the dental mold with facial anatomy should be brought into consideration, and is also an essential factor to harmonize dental mold with facial anatomy so realism can be attained [2]. Aesthetics values from the face of human are determined by the arrangement of anterior teeth [3]. The unwanted change appears in the facial expression due to any anomaly

present while making prosthetic teeth. Appropriate size selection of the maxillary anterior denture teeth is difficult and complicated for complete denture prosthodontics. Numerous recommendations are available in the literature for shaping and defining the size of the teeth, however, a difference of opinion is recorded for their significance [4]. Some authors consider teeth width to be more critical than the length [4,5]. A study suggested that BZ in ratio to maxillary central incisor is 16:1 or vice versa [6]. If facial measurements are recorded, then the possibility of larger CI could occur [1]. In contrast to earlier study, it was believed that larger teeth should be used in all patients instead of smaller teeth [7].

To assure realism to the patient, factors such as age, gender, cultural and social norms should be kept into consideration for dentogenic restorations. Surrounding

oral and facial, features and structures should be in proportion with the size, shape, and shade of the prosthetic teeth [8]. Teeth denture selection and setting should be in the proper proportion that can be beneficial to an aesthetic and natural visual appearance. Certain reference points of the face should be measured and selected for obtaining anterior teeth width. In a number of studies, a digital photography was chosen as the medium to study facial features and found practical and efficient results [9,10], whereas, few other used conventional approach by using digital caliper to analyze the facial features [11].

Expression of face and phonetics, alignments and teeth proportion concerning to face are considered for dental aesthetics. These features are not only limited to mere visual appearance but also serves (intentionally or unintentionally) as a non-verbal communication medium for our emotional states, as it is mirror through it. Thus facial muscles movements (both shortenings and extensions) communicate our feelings of anger, fear, joy, etc., without speaking a word. Impaired and anomaly in dentition can be treated to achieve a healthy and appropriate appearance, which serve the primary aim of dental aesthetics. Application of dental aesthetics and for impaired dentition is a multifaceted job, it resides a mandatory interdisciplinary (orthodontic, restorative and periodontal) approach to achieve a comprehensive plan for treatment. According to a study a treatment plan involves detailed diagnosis thorough evaluation of patient's oro-facial architecture and functional details [12]. It will not be prejudiced to say facial appearance and dental aesthetics are two sides of a single mirror, as either cannot be separated from other. With the advent and progress in today's world, the present generation is more concerned not only with their dental aesthetic but with their facial appearances. Thus results in augmented attention in achieving and obtaining treatment for dental aesthetics [13]. In both removable and fixed prosthodontics, measuring the maxillary anterior teeth is considered an essential feature for aesthetic. Facial measurements and natural teeth to the proportion of facial structures provide supplementary assistance in selecting the teeth denture in addition to determining ideal teeth size for fixed restorations. Numerous guidelines are available that proposed ways to calculate the width of the maxillary anterior teeth, in cases where pre-extraction records are not available. These guides include widths of bizygomatic and interalar, and interpupillary plane [14].

The size of the teeth and the face have a certain relationship which has been found and studied by various researchers. As maxillary anterior teeth play a significant role in case of edentulous patients seeking dental aesthetics thus they should be in harmony with their facial structures [9,15,16]. Various studies and researches [3,17,18], have studied the connexion between the anthropometric measurements of the face and the combined width of maxillary anterior teeth. Consequently, a ratio between the tooth size in correspondence with the facial size is established which serves as a guide and standard in selecting artificial denture teeth. The primary limitation of this approach is that the measurements of soft-tissue are subjected to change. The use of stable facial references and those that are not subject to any change can be used to overcome this issue.

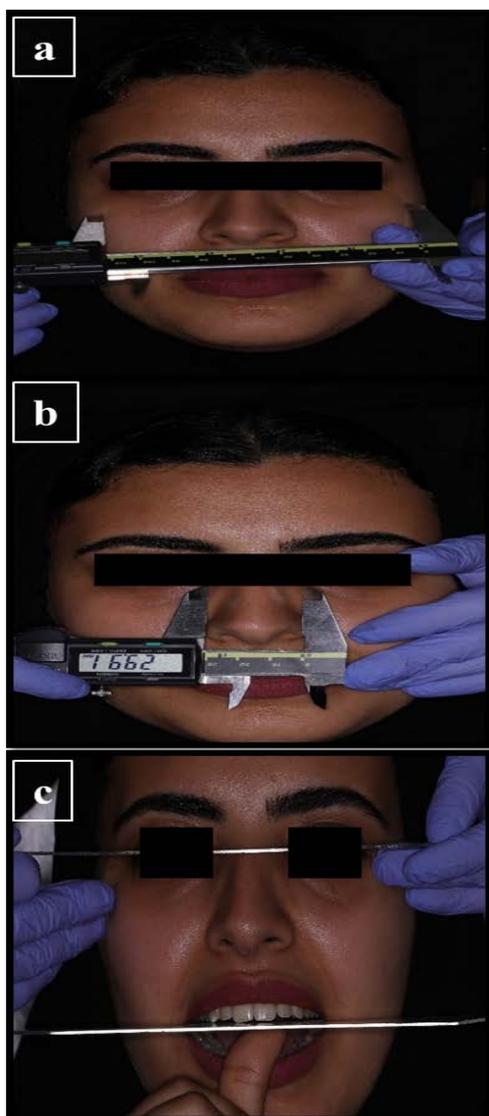
The interpupillary distance is one of the stable facial landmarks which do not change or alter after the age for fourteen [19]. Facial landmarks (IA, inter-commissural width, and interpupillary width), when studied in four different racial groups fail to demonstrate a correlation among them [19], as well as, a weak correlation was found for distoproximal surfaces of canines and inter-commissural width [19]. These studies signify that dental aesthetics and facial features vary from one particular race to another. To the best of my knowledge, no studies have evaluated the relationship between dental complex and facial features (bi-zygomatic width, inter-alar width, and inter-papillary plane) among the Saudi population. Previously, dental complex and few other facial features of other races were studied and found to have a substantial relationship between them. Thus, for the Saudi population, an aesthetic relationship between dental complex and the facial features could exist. The primary purpose of this cross-sectional study was to investigate the relationship between the dental complex and facial features among the Saudi population, so a better understanding of dental aesthetics can be achieved that are more natural and appropriate for the patients.

## 2. Materials and Methods

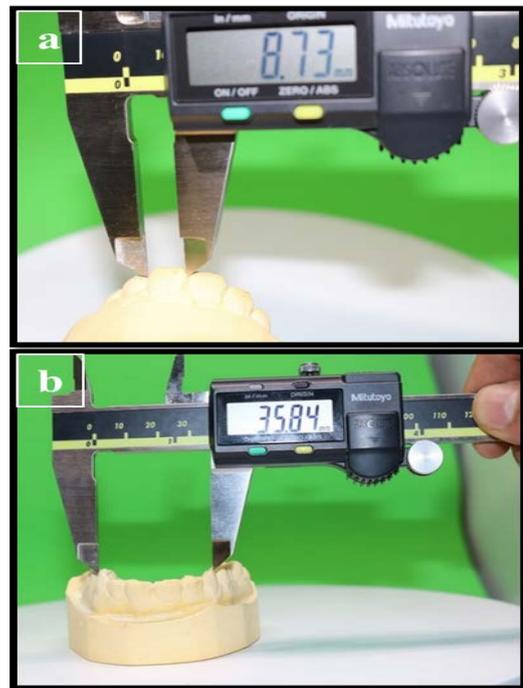
In this prospective cross-sectional study 200 patients, age range between 18-40 (both gender) visiting the dental clinics for a routine dental check-up at the Riyadh Elm University Hospital from July 2018 to February 2019 were incorporated. Inclusion criteria: should be of Saudi descent (both mother and father), all maxillary teeth present and should be in good condition, no dental restoration such as crown or prosthesis for the maxillary teeth as they may change the dimension of the teeth and all teeth should be well-aligned and morphologically normal. Whereas exclusion criteria were having a history of trauma to the teeth, history of maxillofacial surgery or plastic surgery, history of orthodontic treatment, asymmetric face, any neuromuscular disorder treatment and crowding or spacing in teeth. Approval for the study was obtained from the ethical review board at the research centre of the Riyadh Elm University. All the participants provided written informed consent and were briefed about the study before the start of the experimental phase. All the volunteers were seated comfortably on a dental chair in an upright position with the head resting against the headrest.

Facial properties were measured in three phases for each volunteer. First, the measurement was the relative relation between bizygomatic distance and the width of the upper central incisor see [Figure 1a](#) and [Figure 2a](#), respectively. Second measurements were the relative relation between IA and the width of maxillary intercanine distance from tip to tip, see [Figure 1b](#) and [Figure 2b](#), respectively. Lastly, the third measurement was parallelism between the interpupillary plane and the upper dental plane (see [Figure 1c](#)). The facial feature mentioned above were measured with the help of a digital caliper, fox plane, and casts. Keeping in mind the standard aesthetic rules of other races and ethnicities, the bizygomatic distance and the width of the central incisor should be of the ratio 1:16, width of the intercanine distance from tip to tip should be like that of IA, and upper plane should be parallel with the

interpupillary plane. All the subjects' measurements were done at the frontal side using digital caliper (Mitutoyo™, 500-171-30 Advanced Onsite Sensor Absolute Scale Digital Caliper). Criteria for measuring the BZ was that facial width is taken between the most lateral points on the external surfaces of the zygomatic arches, for measuring the IA the external width of the ala of the nose at the widest point and for measuring interpupillary plane parallel with the upper plane. Maxillary arches impression was obtained using Prim-Rock (Whip Mix, Louisville, USA) and later on poured in Jeltrate (Dentsply Petropolis, Brazil). Total of nine readings was obtained from each volunteer by one operator, three reading for each facial feature without any time interval so a mean can be taken for each facial feature to increase the reliability and decrease the chance of error. All the data obtained were entered on customized design proforma. To find a correlation, T-test and Pearson correlation analysis were performed using SPSS software version 24.0 (SPSS Inc., Chicago, IL, USA), where  $p \leq 0.05$  will be considered to be statistically significant.



**Figure 1.** (a) Measurement of Interalar width (the external width of the ala of the nose at the widest point), (b) Bizygomatic width (the facial width is taken between the most lateral points on the external surfaces of the zygomatic arches), (c) Measurement of Interpupillary plane parallel with the upper occlusal plane



**Figure 2.** (a) Measuring the width of central incisor (measured between the widest area between interproximal contact point), (b) intercanine distance (arch width from the canine tip of upper left canine to canine tip of upper right canine)

### 3. Results

The present study represents the relative relation between bizygomatic distance with the width of the upper central incisor, the relative relation between IA and the width of maxillary intercanine distance, and the parallelism between the interpupillary plane and the upper dental plane, were measured on 200 subjects. The number of male and female volunteers were equal i.e. 100 each, with an average age of  $26.51 \pm 6.33$  years and  $26.58 \pm 5.54$  years for males and females, respectively. Descriptive and inferential statistical analysis were performed on the data measured.

The measurements for CI for males and females were  $8.6 \pm 0.21$  mm and of females was  $8.47 \pm 0.53$  mm, respectively. Whereas, the mean of inter-canine width was  $35.95 \pm 1.19$  mm and  $35.51 \pm 1.14$  mm for males and female subjects, respectively (Figure 3).

Figure 4 exhibits the facial measurements of Bizygomatic width for males and females with a mean of  $113.9 \pm 3.2$  mm and  $121.3 \pm 7.79$ , respectively. Also, mean values for IA among male subjects was  $37.32 \pm 1.3$  mm and female subjects were  $34.36 \pm 2.3$  mm.

The measurements for inter-pupillary and occlusal planes of all subjects exhibited parallel to each other. Inter-alar distance mean values ( $37.32 \pm 1.5$  mm) were greater than the mean values of maxillary inter-canine distance ( $35.95 \pm 1.19$  mm) among males, though females depicted opposite relation where inter-alar distance mean values ( $34.36 \pm 2.3$  mm) were lesser than the mean values of maxillary inter-canine ( $35.51 \pm 1.14$  mm).

To measure the relationship between dental complex parameters with facial parameters among all the volunteers, both male and female, Pearson's correlation

test was performed. A weak to moderate positive correlation (Table 1) was found in BZ (facial parameter) and IC (dental complex parameter), as well as for IC (dental complex parameter) and IA (facial parameter). In contrast, a weak negative correlation between CI (dental

complex parameter) and IA (facial parameter), and also CI (dental complex parameter) and BZ (facial parameter) was found. The measurements for inter-pupillary and occlusal planes of all subjects exhibited parallel to each other.

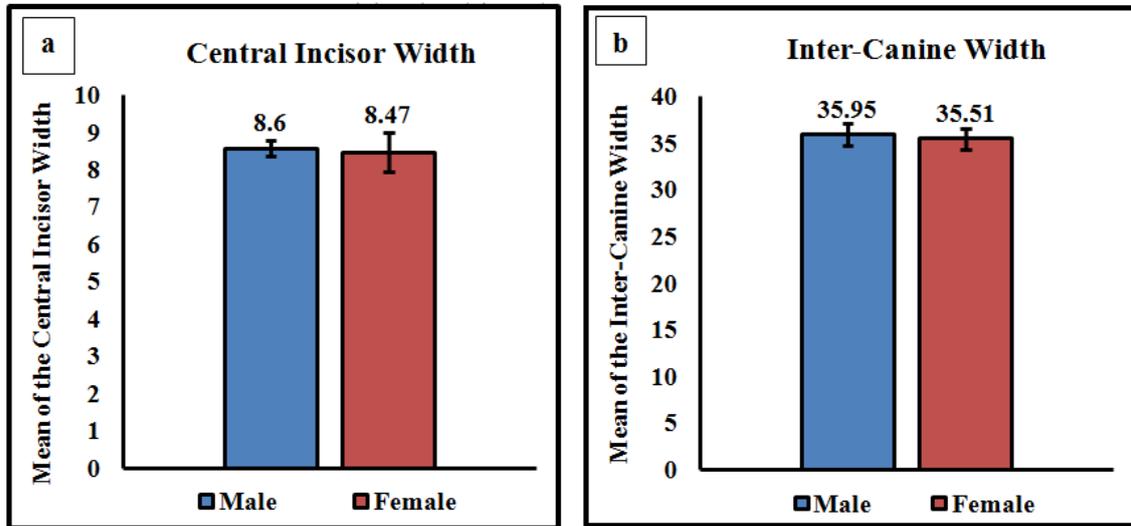


Figure 3. Distribution of dental parameters for both male and females (a) Central Incisor width, (b) Inter canine width

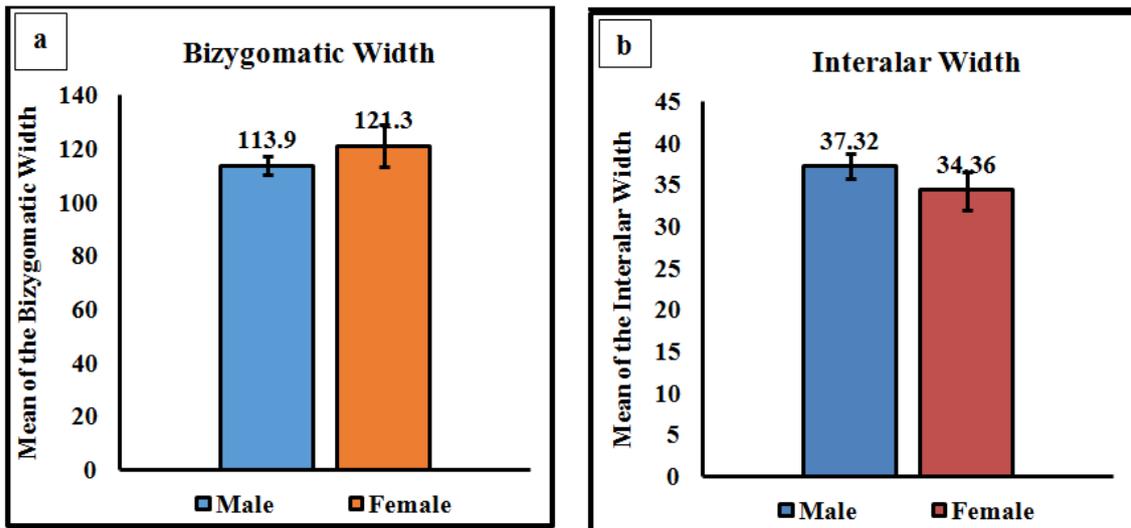


Figure 4 Distribution of dental parameters for both male and females (a) Bizygomatic width, (b) Interalar width.

Table 1. Correlation between facial and dental complex parameter; Bizygomatic width (BZ), Inter canine width (IC), Interalar width (IA) and Central Incisor width (CI)

		BZ	CI	IA	IC
BZ	Pearson Correlation	1	-.053	-.031	.267**
	Sig. (2-tailed)	nil	0.455	0.659	0.00
	N	200	200	200	200
CI	Pearson Correlation	-.053	1	-.140*	.202**
	Sig. (2-tailed)	0.455	nil	0.047	0.004
	N	200	200	200	200
IA	Pearson Correlation	-.031	-.140*	1	.323**
	Sig. (2-tailed)	0.659	0.047	nil	0.00
	N	200	200	200	200
IC	Pearson Correlation	.267**	.202**	.323**	1
	Sig. (2-tailed)	0	0.004	0	nil
	N	200	200	200	200

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

## 4. Discussion

In general, many facial and dental complex parameters vary due to geographical location, weather conditions and historical background among the different population which shapes and transforms genes of human beings. Hence dental practitioner should consider patients roots, culture, and norms that tend to be useful when restoring teeth for facial aesthetics. Dealing with the dental complex anomaly, many studies have been conducted in the past to understand the size and morphology of the dental complex with facial features to assist generalization for different racial norms and gender characteristics.

To measure racial and gender differences, extracted teeth were the only medium available for teeth measurements especially in case of earlier studies. Though, nowadays in most of these studies dental clinicians use casts for intraoral evaluations to measure tooth dimensions, also maxillary CI can be used to measure the differences for different races and different gender. This study was solely undertaken on the Saudi population to identify the aesthetic relationship between the dental complex features and the facial features, and also to assess the parallelism between the interpupillary plane and the upper dental plane. The bizygomatic distance was compared with the upper CI to compare its measurements with the earlier aesthetic rules and findings. Similarly, IA was also compared with the maxillary IC and compared to the approved aesthetic rule. To satisfy the aesthetics treatment to the patient's anterior teeth are primarily selected by the dentist. According to teachings of dental fabrication greatly vary for patients requiring facial aesthetics. The appearance of aesthetic denture greatly differs with patient's perception of aesthetics [20]. The characterization of ideal dental aesthetics in a particular race or ethnicity can be greatly influenced by several cultural, psychological, and social factors [21]. To select an aesthetic dental procedure that is satisfying to the patient, dentist not only needs to have scientific knowledge whilst his own creative and artistic skills should be present as well [22]. As dental and facial parameters can greatly vary from one person to another even of the same race or ethnicity due to their own hereditary and genetic traits. Therefore, it is obvious that for restoring anterior teeth for aesthetics measurements of dental and facial parameters may provide practical information to the dentist, thus this information can also be of significant importance to forensic experts as well. Facial features using extracted teeth have been compared with the size and morphology of the maxillary anterior teeth in an earlier study [23] and widely agreed that for the width selection of the anterior teeth, teeth should be in relation to facial measurements and features.

In our findings, the central incisors mean value for men ( $8.6 \pm 0.21$  mm) were significantly greater than the female ( $8.47 \pm 0.53$  mm) central incisors mean value. As men tend to wider bony structures thus their anterior teeth are also wider. Consequently, our findings for central incisors mean values are coherent with earlier studies, where men said to have wider anterior teeth and longer maxillary anterior teeth than the women [24,25,26]. Our measurements for mean value of BZ of males and females were  $113.9 \pm 3.2$  mm and  $121.3 \pm 7.79$  mm, respectively, which falls same as the earlier findings, where females have wider BZ

as compared to males [24]. The wider BZ width in females is due to the presence of denser soft tissues on the face in comparisons to males. Central incisor and BZ displayed a weak negative correlation in males and females from our findings, it was noted that increase in CI width have inverse relation on BZ width which contradicts earlier findings [27]. However, another study corroborates our findings for BZ, where female patients were having higher BZ in comparisons to males [5]. A strong justification for this inverse relationship is due to the presence of denser soft tissues on females face whereas, the wider bony structures are found in males. A study also states that BZ correlates with maxillary central incisor [27] as well, but another study contradicts such findings and their use on patients [28]. IC mean values in males and females do not display a significant difference, although a higher mean value was recorded for male's participants. A strong statistically significant difference was found in interalar distance from our study in Saudi population which are line with earlier studies [22,29,30]. A weak to moderate positive correlation was found in IC and IA.

Earlier study found that the interpupillary line is parallel to occlusal plane among all the subjects [31], that also strengthen our similar findings. This shows that there is no facial anomaly present among the Saudi population as the interpupillary line is parallel to occlusal plane. The measurements for the maxillary anterior teeth width using IA was also found of the same size and proportion as earlier studies conducted on Saudi population [22]. There are number of studies conducted for facial and dental parameters among different groups of people across the world, few of them have a partial or full contradiction with each other. Similarly, our study contradicts findings of Latta et al. for facial measurements as they found no correlation between facial measurements in their study [32,33]. In contrast, our findings established a correlation between facial and dental parameters which is supported by many earlier studies [34]. Although this cross-sectional study was carefully prepared, there were some unavoidable limitations. For measuring the facial parameters, our study only relied on soft tissue (IA). To overcome this shortcoming, future studies should include bony facial landmarks instead of IA. Our study was conducted in Riyadh, our results might vary if the same study is performed across Saudi Arabia. We recommend more studies and research should be done for similar and other aesthetic features on larger groups with greater sample size across Saudi Arabia.

From the result of the present study, it was concluded that a positive and strong aesthetic relationship between facial features and dental complex is present among the Saudi population. Furthermore, aesthetic measurements among the Saudi population also tends to be parallel to current standard aesthetic rules followed by the dental practitioners.

## References

- [1] Williams, J.L., A new classification of human tooth forms with special reference to a new system of artificial teeth. *J Allied Dent Soc*, 1914. 9: p. 1-52.
- [2] Lombardi, R.E., The principles of visual perception and their clinical application to denture esthetics. *The Journal of Prosthetic Dentistry*, 1973. 29(4): p. 358-382.

- [3] Deogade, S.C., et al., The relationship between innercanthal dimension and interalar width to the intercanine width of maxillary anterior teeth in central Indian population. *The Journal of the Indian Prosthodontic Society*, 2015. 15(2): p. 91.
- [4] Varjão, F.M. and S.S. Nogueira, Intercommissural width in 4 racial groups as a guide for the selection of maxillary anterior teeth in complete dentures. *International Journal of Prosthodontics*, 2005. 18(6).
- [5] Hasanreisoglu, U., et al., An analysis of maxillary anterior teeth: facial and dental proportions. *The Journal of Prosthetic Dentistry*, 2005. 94(6): p. 530-538.
- [6] Berry, F., Is the theory of temperaments the foundation of the study of prosthetic art. *Dent Mag*, 1905. 1(405): p. 6.
- [7] Özkan, Y.K., *Complete Denture Prosthodontics: Treatment and Problem Solving*. 2018: Springer.
- [8] Rai, R., Correlation of nasal width to inter-canine distance in various arch forms. *The Journal of Indian Prosthodontic Society*, 2010. 10(2): p. 123-127.
- [9] Gomes, V.L., et al., Correlation between facial measurements and the mesiodistal width of the maxillary anterior teeth. *Journal of Esthetic and Restorative Dentistry*, 2006. 18(4): p. 196-205.
- [10] Al Ali, K., Current concepts of selecting teeth for complete dentures among dentists in Riyadh; Saudi Arabia. *Pakistan Oral and Dental Journal*, 2009. 29(1): p. 177-180.
- [11] Lucas, B., et al., Distance between the medialis angles of the eyes as an anatomical parameter for tooth selection. *Journal of Oral Rehabilitation*, 2009. 36(11): p. 840-847.
- [12] Rifkin, R., Facial analysis: a comprehensive approach to treatment planning in aesthetic dentistry. *Practical Periodontics and Aesthetic Dentistry*, 2000. 12(9): p. 865-871.
- [13] Haq, S., N. Khan, and O.K. Durrani, Assessment of psychosocial impact of dental aesthetics. *Pakistan Orthodontic Journal*, 2018. 10(1): p. 2-7.
- [14] Ahmad, I., *Predictable Aesthetic Dental Restorations*. 2006: Wiley Online Library.
- [15] BALEEGH, S., et al., The Relationship Between Widths Of Upper Anterior Teeth And Facial Widths. *Pakistan Oral & Dental Journal*, 2015. 35(4).
- [16] Ward, D.H., Proportional smile design: using the recurring esthetic dental proportion to correlate the widths and lengths of the maxillary anterior teeth with the size of the face. *Dental Clinics*, 2015. 59(3): p. 623-638.
- [17] MahdaviZadi, Z., H. AzangooKhiavi, and Y. Dadpour, Relationship between the Mesiodistal Width of Maxillary Central Incisor and Interpupillary Distance. *Journal of Mashhad Dental School*, 2010. 34(1): p. 1-6.
- [18] Kazanji, M., et al., Relation of Maxillary Central Incisors Width to some Facial Measurements. *Journal of Oral and Dental Research*, 2017. 4(2): p. 93-101.
- [19] Deogade, S., et al., Correlation between combined width of maxillary anterior teeth, interpupillary distance and intercommissural width in a group of Indian people. *International Journal of Prosthodontics and Restorative Dentistry*, 2014. 4(4): p. 105-111.
- [20] Prica Oreški, N., A. Čelebić, and N. Petričević, Assessment of esthetic characteristics of the teeth and surrounding anatomical structures. *Acta Stomatologica Croatica*, 2017. 51(1): p. 22-32.
- [21] Aldaj, M., et al., Patient Satisfaction with Dental Appearance and Treatment Desire to Improve Esthetics. *Journal of Oral Health & Community Dentistry*, 2018. 12(3).
- [22] Al-el-Sheikh, H. and M. Al-Athel, The relationship of interalar width, interpupillary width and maxillary anterior teeth width in Saudi population. *Tropical Dental Journal*, 1998: p. 7-10.
- [23] Alsaadi, A., M. Mahdi, and I. Almarzooq, Use of facial Indicator for choosing anterior teeth. *Advance Dental & Oral Health*, 2015. 1(2).
- [24] Rawat, A., et al., Evaluation of relation between bizygomatic width and mesiodistal dimension of maxillary central incisor in Indian Population: An in vivo study. *International Journal Of Scientific Study*, 2015. 3(6): p. 38-42.
- [25] Sterrett, J.D., et al., Width/length ratios of normal clinical crowns of the maxillary anterior dentition in man. *Journal of Clinical Periodontology*, 1999. 26(3): p. 153-157.
- [26] Song, J.-W., et al., Analysis of crown size and morphology, and gingival shape in the maxillary anterior dentition in Korean young adults. *The Journal of Advanced Prosthodontics*, 2017. 9(4): p. 315-320.
- [27] Scandrett, F.R., Kerber P.E., and Umrigar Z.R., A clinical evaluation of techniques to determine the combined width of the maxillary anterior teeth and the maxillary central incisor. *Journal of Prosthetic Dentistry*, 1982. 48(1): p. 15-22.
- [28] Neda, A.-K. and B.T. Garib, Selecting maxillary anterior tooth width by measuring certain facial dimensions in the Kurdish population. *The Journal of Prosthetic Dentistry*, 2016. 115(3): p. 329-334.
- [29] Shivhare, P., et al., Intercanine width as a tool in two dimensional reconstruction of face: an aid in forensic dentistry. *Journal of Forensic Dental Sciences*, 2015. 7(1): p. 1.
- [30] Dias, P.E.M., et al., Practical application of anatomy of the oral cavity in forensic facial reconstruction. *PIOS One*, 2016. 11(9): p. e0162732.
- [31] Silva, B.P., et al., Layperson's preference regarding orientation of the transverse occlusal plane and commissure line from the frontal perspective. *The Journal of Prosthetic Dentistry*, 2017. 117(4): p. 513-516.
- [32] Latta G.H.Jr., Weaver J.R, and Conkin J.E., The relationship between the width of the mouth, interalar width, bizygomatic width, and interpupillary distance in edentulous patients. *Journal of Prosthetic Dentistry*, 1991. 65(2): p. 250-254.
- [33] Parciak, E.C., et al., Comparison of maxillary anterior tooth width and facial dimensions of 3 ethnicities. *The Journal of Prosthetic Dentistry*, 2017. 118(4): p. 504-510.
- [34] Ali, Z., et al., Oral health-related quality of life after prosthodontic treatment for patients with partial edentulism: a systematic review and meta-analysis. *The Journal of Prosthetic Dentistry*, 2019. 121(1): p. 59-68. e3.

